University of Central Florida

NSF NUE @ UCF

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Co-PI(s)

A. Bhattacharya (Physics): C. Siders (Optics)

B. Rzigalinski (Molecular & Microbiology): Pastel (Chemistry)

A. Sweeney (Education): E. Vittes (Liberal Studies)

UNIVERSITY OF CENTRAL FLORIDA, Orlando

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EEC: 0304525

Nanotechnology Science and Engineering Education (NSEE) Workshop
September 28-30, 2003, Arlington, Virginia

Thanks!!!

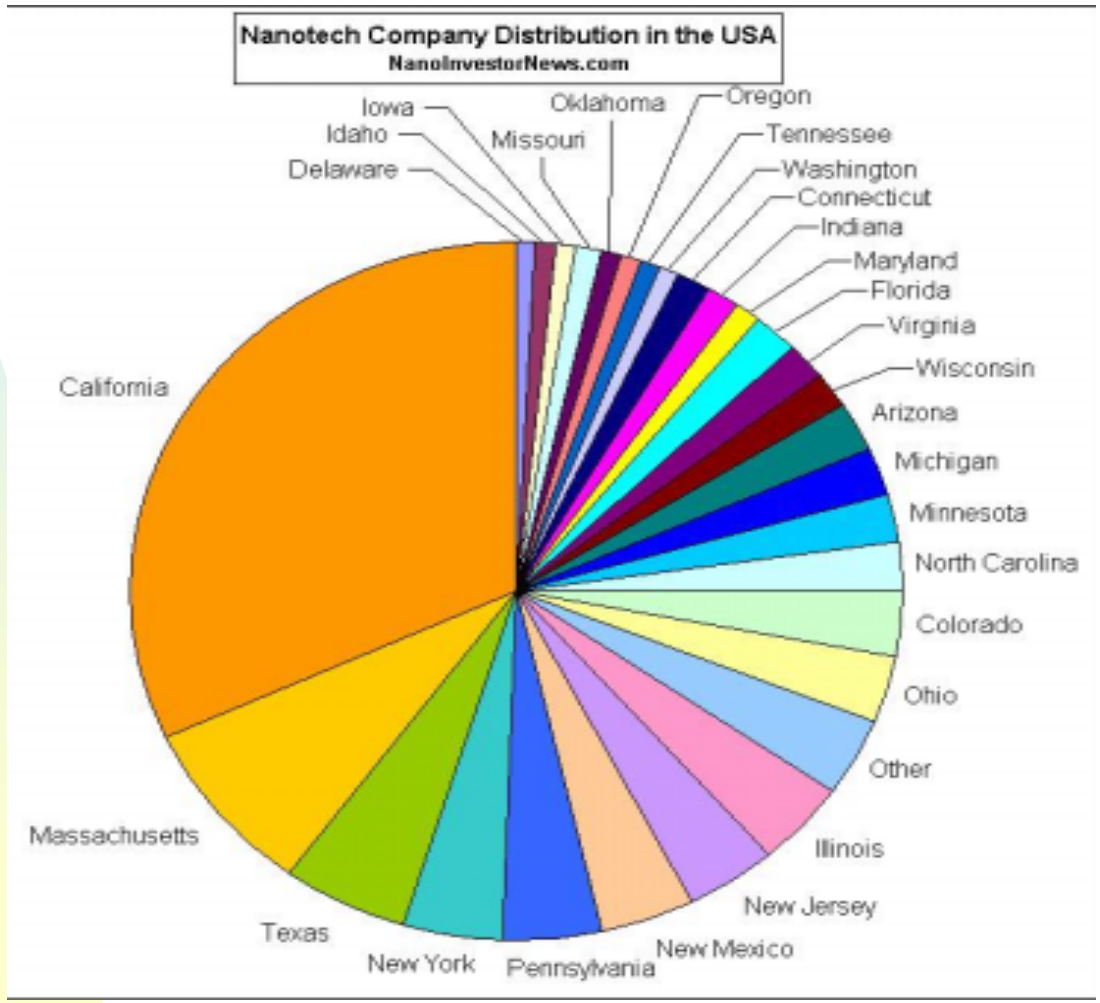
- EEC: 0304525: Mary Poats - EEC DIV OF ENGINEERING EDUCATION AND CENTERS, ENG DIRECTORATE FOR ENGINEERING

- Thanks to Spud Bradely, M. Clarke - NSF for NSF PANEL
- And the Workshop Organizer

- UCF Administration:
  - MJ Soileau (VP Research),
  - P. Vaidyanathan (Vaidy) - Asst.VP Research,
  - J. Schell and G. Whitehouse (Provost) and
  - the Deans and Directors of Engineering, Centers and College of Arts and Sciences, and Education

Nanoinitiative @ Florida

- *There is an urgent need..*



The University of Central Florida

Five Colleges

- Arts and Sciences
- Business Administration
- Education
- Engineering
  - School of Electrical Engineering & Computer Science
- Health and Public Affairs

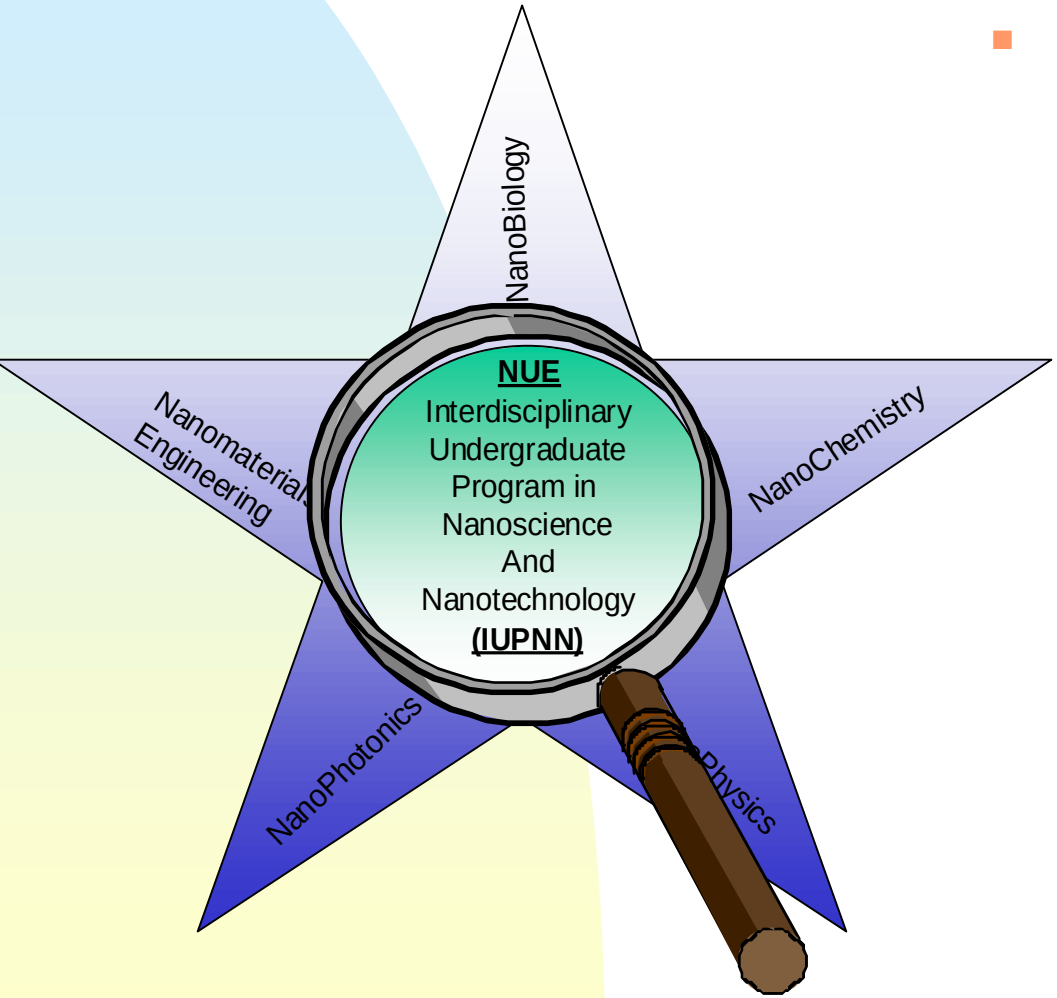
Advanced Degrees

- 64 master's degree programs
  - 3 specialist degree programs
  - 20 doctoral degree programs

Classes began in 1968 with 1,948 students
2002-03 enrollment exceeds 42,000
By size 15th rank in Nation
MIT Score Card: 38th in Nation, 2nd in Florida

Nanoinitiative @ UCF

38 Faculty Involved



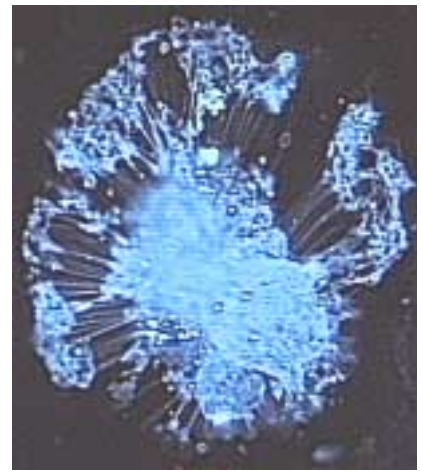
- *Nanoinitiative - 01- 4.5 mil/ys*
  - *Goals and Mission*
  - *NSF REU - Nanotechnology*
  - *New Faculty Hires - Nano*
  - *Nanocomission*
  - *Nano Science and Tech Center*
  - *NSF NUE program*
  - *Prestigious Awards*
    - *NSF CAREER*
    - *ONR YIP*

UCF Nanoactivities - Key Facilites

Creol/SoO
- Nano E Beam Lithography
- Stepper
- Clean Room

MCF, AMPAC
- TEM, SEM, XPS, AES, SIMS
- RBS, XRD, FIB\

FSEC
- Solar Energy Center

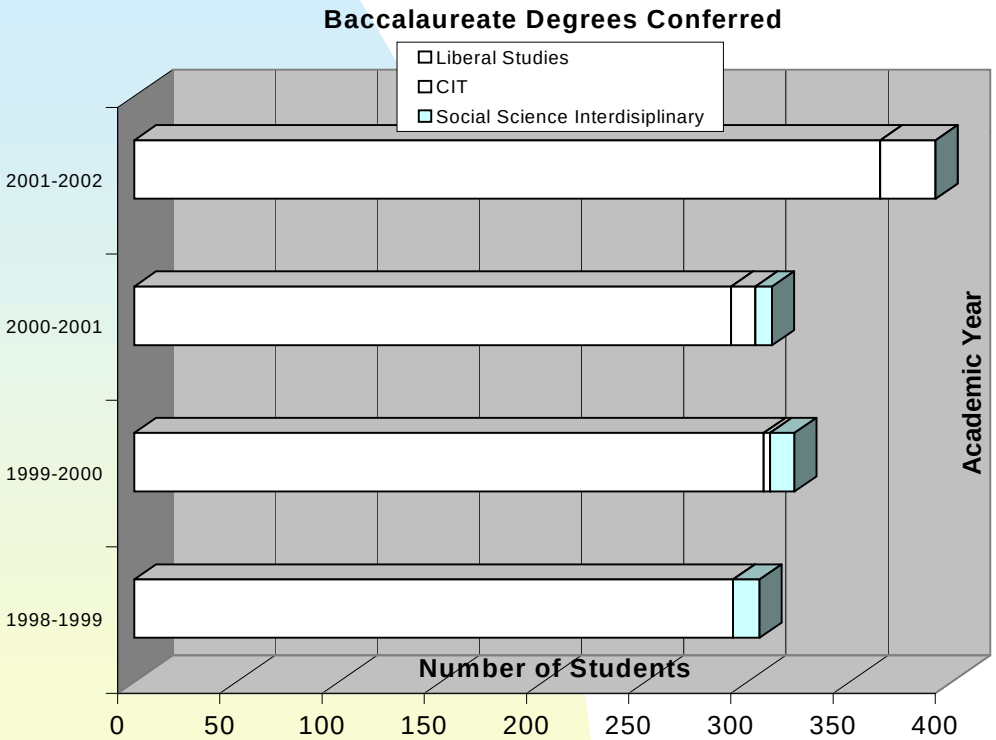


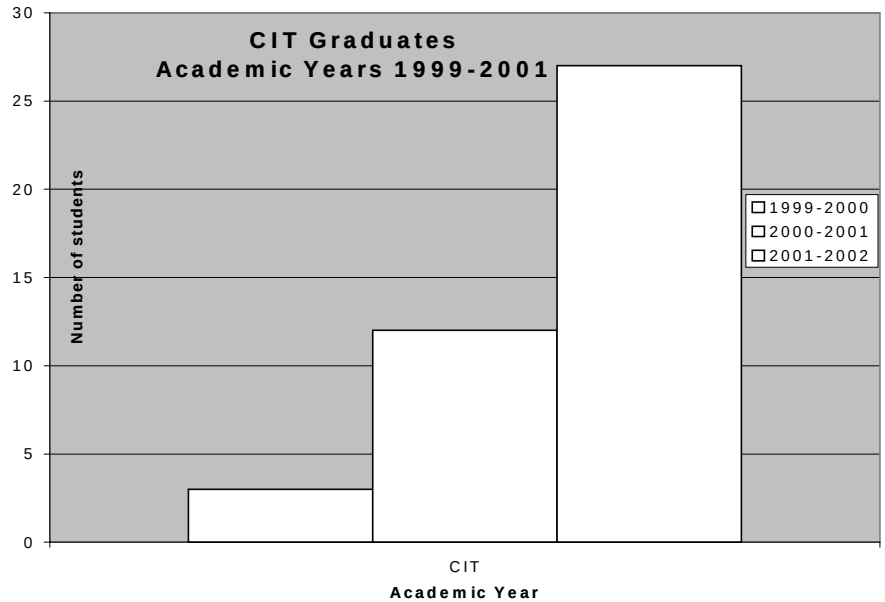
NUE Administration

- *Why Liberal Studies..*
  - *Putting together a Team*
  - *Coherence*
  - *Information Summation*
  - *Challenges - Facts*
    - ***Inputs***
      - ***Engineering***
      - ***Physics***
      - ***Chemistry***
      - ***School of Optics***
      - ***Molecular and Microbiology***
      - ***Education***

NUE Administration

- *Why Liberal Studies..History*





Course Structure

- Minors for Nanotechnology (18 credit min)
- Subject Area I (18 Credit min)
- Subject Area II - Nanoscience and Nanotechnology (18 Credit min)
- Nanocourses (24 credits)
  - Nanomaterials Process and Engineering (Seal)
  - Nanomaterials Characterization and Applications (Seal)
  - NanoPhysics (Bhattacharyaya)
  - NanoPhotonics (Siders)
  - NanoBiotechnology (Rzigalinski)
  - Ethics and Societal Implications in Nanotechnolgy (Jones/Sweeney)

Course Administration

- Team tough vs Individual
  - Timing issues
- Challenges
  - Credit splits
  - SCH Generation
  - Syllabus
  - Individualized Tracks
- Overcome of Challenges
  - Ownership
  - Course Rotation
  - Incentive program
  - Budgets

How did we decide these Courses?

Research

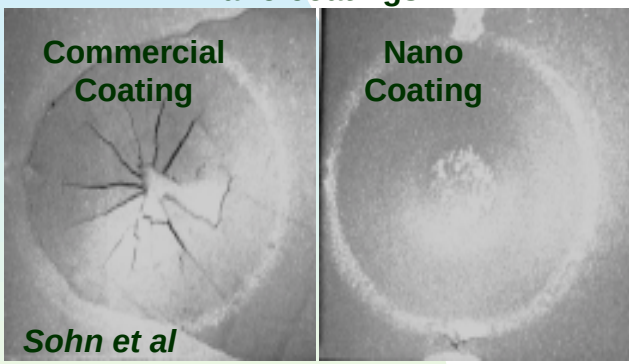
Education

(some Key Examples)

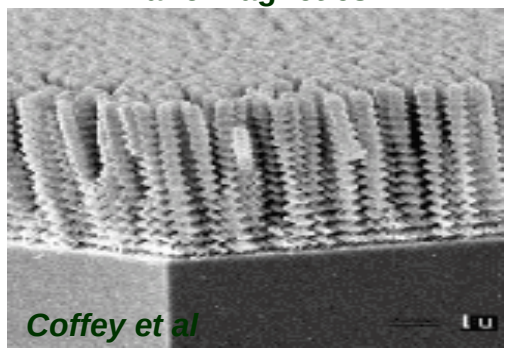
Research @ Engineering/Materials

- Our Strengths - Processing and Characterization
- Strategic Decision Dept Chairs and Directors - Hiring

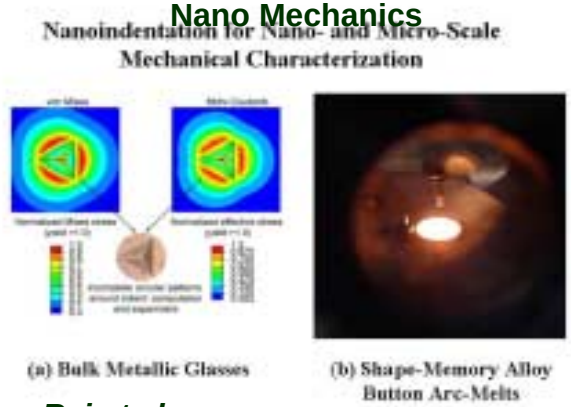
Nano coatings



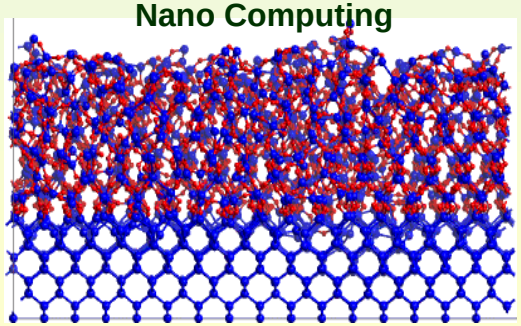
Nano magnetics



Nano Mechanics



Nano Computing

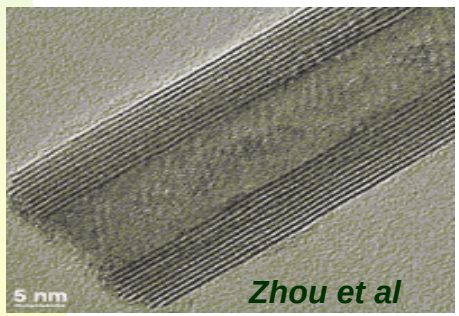


Shelling et al

In Solution

S. Seal

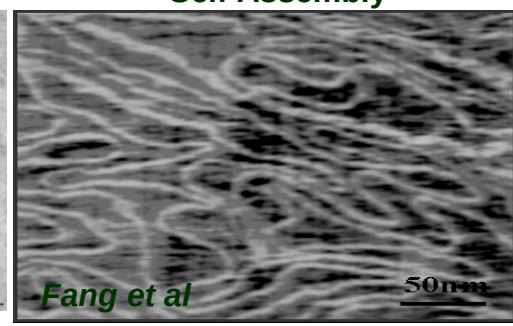
Nano Tubes



On Surface

Nanoparticle/Cell

Self Assembly



Education @ Engineering/Materials

- **NEMA 4XXX: Introduction to Nanomaterials Process Engineering (3 credits)**
  - A Global Overview of Nanomaterials Research
  - Nanotechnology for Nonscientist and Engineers
  - Processing of Nanomaterial
  - Advanced Nanomaterials
  - Nanomachining and Nanostructuring
  - Nano Composites
  - Nanofabrication Techniques
  - Computational Fault Detection in Nanosized Devices

- **NEMA 4XXX: Nanomaterials Characterization and Applications (3 + 2 credits lab)**
  - Characterization of Nanosized Materials
  - Hands on Experience on Nanoscale Characterization Instrumentation
  - Size-Scale Issues in the Mechanical Behavior of Materials
  - Nanostructured Coatings for High Strength- and Temperature Applications
  - Corrosion and Environmental Degradation of Nanostructured Materials
  - Nanoscale Magnetic Materials and Devices
  - Quantum Dots for Solar Cell Applications
  - Nanoscience and Technology in the Advancement of Hydrogen Economy

  - S. Seal, C. Sury, Raj, Y. Sohn, V. Desai, K. Coffey, A. Raissi, N. Muradov, N. Dhere, R. Demara, Lucille, L. An, J. Fang, S. Kalita, C. Klemenz (15)

NUE at UCF Physics Department

Title: Introduction to NanoPhysics:

- Electron Field emission from Carbon Nanotubes
- Massively Parallel Nanofabrication Using Biological Masks
- Self-assembly of magnetic nanostructures in magnetic colloids
- Transport in nanostructures
- Understanding Nano Self-assembly and transport through computer simulation:
- Electron Dynamics in AlGaN/GaN
- Spectroscopy at the micro- and nanometer scales
- Nanoscale local structure at impurities in minerals

W. Luo, A. Bhattacharyay, A. Shulte, L. Chow, A, Winningham, M, Johnson, L. Chernyak, R. Peale (8)

SEE POSTER BY Aniket Bhattacharyaya

Funding: NSF, NSF-NER, NSF-NIRT, NSF-NUE and NSF-CAREER awards.

NUE at UCF College of Education

- Development of Nanoscience Modules and Interactive Virtual Nano-Labs for use in undergraduate curriculum:
- *Does this approach improve conceptual understanding?*

Research, cont/d

- Use “cognitive processing” research to probe student understandings of fundamental concepts in nanoscience.
- *May typical/common misconceptions be identified and remediated via instruction? (cf. physics education research literature)*

Grading Evaluation

Grades: Each lecturer will assign a quiz/homework to be graded. Each student will write a short report on the course on a particular topic.

Outcome: The course will allow undergraduate students to have research experiences at the laboratories and training at the computational facility of the Department of Physics, UCF.

Where are we now???

Liberal Studies and Nanotechnology: A Perfect 21st Century Combintation

Liberal Studies students have the opportunity to study across disciplines and access skills that make them excellent candidates in the job market. This multi-dimensional degree allows students to blend not just the classics with the sciences, but scientific fundamentals with the highest technologies. The Nanoscience and Nanotechnology track provides an ideal manner for students to prepare for employment and for graduate school. Students can use their degree to great advantage by highlighting their course work and fields of study. Recruiters from major businesses are excited by the Liberal Studies Program at UCF.

Transferrable Skills Gained from a Liberal Studies Education

- Written and Oral Communication
- Adaptability to Change
- Critical and Analytic Thinking
- Problem-Solving
- Quantitative Skills

The planning for this program, "NUE: An Interdisciplinary Unidergraduate Program in Nanoscience and Nanotechnology (IUPNN) is sponsored by the National Science Foundation and the University of Central Florida.

The Nanotechnology field is one encouraging researchers to think "small." We endeavor to help students prepare for thinking about nanotechnology by bringing a degree with both depth and breadth to bear on the discipline. A strong interdisciplinary background weds the technological, scientific, and creative together in a way that promotes expression, experimentation, and cognition. Liberal Studies students have been successful with degree tracks in Computer Information Technology, Liberal Studies, and Liberal Arts, which has led to new offerings in Environmental Studies and Women's Studies. Liberal Studies represents the wave of the future, in thinking "big" about a universe of materials.

Contact Information

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Website:
http://www.cas.ucf.edu/liberal_studies/nano.php

**Have a Big Future....
Investigate an Emerging Small Field:
Nanotechnology**

Liberal Studies cooperates with several departments within four colleges to administer the Nanoscience and Nanotechnology track and the degree. We encourage students to visit affiliated advisors in these units and make their background as inclusive as possible.

UNIVERSITY OF CENTRAL FLORIDA
College of Arts and Sciences

Allison Rae Vittes

Liberal Studies

Nanoscience and Nanotechnology

(Program Expected in Fall 2004)

Nanoscience and Nanotechnology is the study of the structure and behavior of materials at the atomic or molecular level. Through an understanding of how to manipulate atoms and molecules, it is possible to create devices and machines with unique properties and diverse applications.

Where are we now???

Choosing the Nanotechnology Subject Area

Liberal Studies is proposing an interdisciplinary baccalaureate track with an emphasis in Nanoscience and Nanotechnology. The program will be administered by the Office of Liberal and Interdisciplinary Studies, with close advising by the Liberal Studies Advising Team and faculty in four colleges at the university. Students will receive the advantages of a multi-disciplinary approach together with professional advising to maximize the potential of the degree.

General Requirements

- Complete General Education requirements
- Only "C" (2.0) or better grades will count in each course in the subject areas
- Students must declare their major no later than one semester prior to graduation
- New majors must adopt the most current catalog year
- One semester college-level foreign language, or equivalent, or a course with a multi-cultural dimension is necessary for graduation, as well as meeting the university foreign language admission requirements
- No overlapping of courses between a subject area and the minor is allowed

A Multidsciplinary Program and a Multitude of Choices

The two areas and one minor model offers dozens of different possible combinations of studies for a student. Each one provides a background pertinent to nanoscience and nanotechnology and enhances the capability of students to engage in further education or employment in the field. It also represents and enjoyable and challenging set of studies.

Degree Information

What is required in the degree program?

The Nanoscience and Nanotechnology track is a fifty-four credit hour undergraduate degree, composed of two eighteen credit hour areas and one minor.

What does the degree offer that is unique?

The degree offers a unique interdisciplinary approach to undergraduate education and to nanotechnology. At UCF, we believe that students prepared broadly with a solid background in the tenets of nanotechnology are in an excellent position for employment in the technology sector or for graduate education.

Who will advise me?

The Liberal Studies Advising Team -- with specific training in nanotechnology advising -- will assist you in planning and completing the degree in a timely fashion, as the responsible administrative unit. We advise 1,200+ majors, and so are experienced in working with students to maximize their potential. Additionally, you will be advised about content aspects of your degree with expert faculty throughout the many disciplines involved.

The Liberal Studies Office has detailed descriptions and information for the Nanotechnology subject area, or you may visit our website at http://www.cas.ucf.edu/Liberal_Studies/nano.php

Available Liberal Studies Subject Areas for Nanotechnology

Biological Sciences
Computer Science
Engineering
Health
Mathemtical Sciences
Physical Sciences
Individualized

Available UCF Minors for Nanotechnology

Aerospace Studies
Applied Computer Science
Astronomy
Biology
Chemistry
Cognitive Science
Computer Science
English - Technical Writing
Environmental Studies
Health Science
Mathematics
Molecular Biology & Microbiology
Physics
Psychology
Space Studies
Statistics

Nanotechnology Area Courses

Nanomaterials Process Engineering
Nanomaterials Characterization & Application
Nanophysics
Nanobiotechnology
Nanophotonics
Ethics and Societal Implications in Nanotechnology

My Nano Research!!!

- Nanomaterials (oxides) synthesis/Surface Modification - NSF
- Bulk nanostructures using Plasma - ONR YOUNG INVESTIGATOR AWARD-02, and DOD DURIP
- Nanomaterials for Biological Application - NIH (Co-PI)
- Nanostructures for Room T H sensors - NASA
- Nanostructure Microstructure - Property Charac - SBIR Ph I and II from DOE, DOD, NASA, MDA - through Plasma Process Inc.
- Advanced Materials Development - Disney, Siemens, Pratt Whitney, Constellation Technology, Lucent, US Filter, PsiloQuest, Whirlpool

UCF: a great place to live, learn, and play!